Journal of Dental Sciences and Education

Case Report

DOI: 10.51271/JDSE-0034

A new anatomical variation in ramus: the sigmoid canal

Mehmet Emin Doğan, Sedef Kotanlı, Menduh Sercan Kaya

Department of Dentomaxillofacial Radiology, Faculty of Dentistry, Harran University, Şanlıurfa, Turkiye

Cite this article: Doğan ME, Kotanlı S, Kaya MS. A new anatomical variation in ramus: the sigmoid canal. *J Dent Sci Educ*. 2024;2(2):50-52.

Corresponding Author: Mehmet Emin Doğan, meminemindogan@gmail.com

Received: 15/06/2024 ◆ **Accepted**: 23/06/2024 ◆ **Published**: 27/06/2024

ABSTRACT

During the radiological examination with cone beam computed tomography of the patient who complained of joint pain, a structure with a length of 8.1 mm and a diameter of 0.6 mm was detected, starting from the sigmoid notch and descending down the ramus. The patient was unaware of the existence of this structure, and moreover, the patient did not show any symptoms. There was doubt as to whether the observed structure was an anatomical variation or a pathological phenomenon, and magnetic resonance imaging (MRI) was used to determine its content. It was realized that the structure imaged by MRI carried a branch of the maxillary artery. This structure was called the sigmoid canal. It was noteworthy that this anatomical structure was likely to cause complications in surgical interventions.

Keywords: Anatomical variation, ramus, sigmoid notch, mandible

INTRODUCTION

Various anatomical variations can be observed in the human mandible, as seen throughout the entire body.[1,2] Awareness of these variations not only ensures accurate diagnosis but also influences the design of treatment plans.[1] Before the development of imaging systems, anatomical variations were recognized only through surgical procedures and examinations on cadavers; however, with the advancement of imaging systems today, the discovery and evaluation of anatomical variations have become much easier and more widespread.[3,4] Cone beam computed tomography (CBCT) is a highly useful imaging technique for assessing hard tissues due to its high resolution, detail power, and relatively low radiation dose.[5] Additionally, the ability to perform cross-sectional examinations, in addition to multiplanar (axial, sagittal, and coronal) assessments, provides an advantage.[6]

The mandible is the bone that comprises the lower 1/3 of the face. It carries the coronoid process and condylar process on the mandibular ramus. The coronoid process is a triangular structure that protrudes slightly upward from the ramus. The condylar process is a projection on the posterior aspect of the ramus that articulates with the temporal bone, making the mandible the only movable bone in the face. The indentation on the close faces of the coronoid process and condylar process where they join with the ramus is called the sigmoid notch.[7]

Various anatomical variations have been described previously in the human mandible, such as variations in the temporal crest canal, lingual canal, coronoid foramen, and mandibular canal.[8-10] In this case presentation, we aimed to describe a canal starting from the sigmoid canal, which has not been previously described in the literature, and extending inferiorly along the mandibular ramus.

CASE

The patient, a 24 years old female of Turkish descent, reported experiencing difficulty opening her mouth fully and localized pain in her right temporomandibular joint (TMJ) region. Upon detailed examination, clinical findings revealed limited mandibular movement during mouth opening, with tenderness noted upon palpation of the right TMJ area. Additionally, a review of the patient's medical history revealed no significant systemic illnesses or prior surgical interventions related to the maxillofacial region.

Clinical Findings

The patient's medical history does not reveal any surgical operations, medication use, or any pathology. No extraoral asymmetry was observed in the face. Intraoral examination revealed that tooth 46 was extracted 9 years ago, and tooth 47 was mesialized with a periodontal pocket mesially. The lower left dental arch has shifted towards the extraction space. Tooth 13 in the upper right jaw was observed to be rotated. Intraoral examination also revealed cavities at the enamel level on teeth

This work is licensed under a Creative Commons Attribution 4.0 International License.

16, 26, and 27 occlusally. Occlusal decay reaching dentin was detected on teeth 17, 47 and 37. A composite restoration was found on tooth 36, done 3 years ago and now showing signs of poor adaptation. Tooth 38 exhibits partial mucosal retention and mild pericoronitis. In joint examination, deviation to the left side and a clicking sound during opening and closing of the mouth were noted once. Considering the oral findings and the patient's preference, a comprehensive treatment plan was desired.

Reviews

Examinations such as panoramic imaging and periapical imaging were performed initially. CBCT was requested to evaluate the bony components of the TMJ for complaints related to TMJ, and magnetic resonance imaging (MRI) was requested to evaluate the soft tissue components of the TMJ. All imaging and examinations were performed by the authors of this study.

Periapical radiograph evaluation: Incompatibility in the filling of tooth number 36 was confirmed.

Orthopantomography evaluation: It was observed that teeth numbers 18 and 28 were impacted vertically in the patient's panoramic evaluation. A radiolucency consistent with pericoronitis was observed distal to tooth number 38.

CBCT evaluation: Images were obtained using the Castellini X-Radius trio plus (Imola, Italy) dental tomography device with a slice thickness of 1 mm and a voxel size of 0.3 mm, using exposure parameters of 16 mAs and 90 kVp. The patient's images were evaluated in sagittal, horizontal, and coronal sections using IRYS viewer 15.1 software. A full HD screen with a screen size of 15.6 inches and a maximum screen resolution of 1920x1080 was used during the evaluation. No pathology was encountered in the bony components of both TMJs in the patient. A canal with a length of 8.1 mm and a diameter of 0.6 mm, starting from the patient's left sigmoid notch and extending down the ramus, was detected (Figure 1). This canal was called the sigmoid canal. This observed canal was considered an anatomical variation. An MRI examination was considered appropriate for a more extensive investigation and a better understanding of the observed structure. The patient was informed that this structure observed in the bone might affect future surgical interventions, and with the patient's consent, MRI images were obtained.

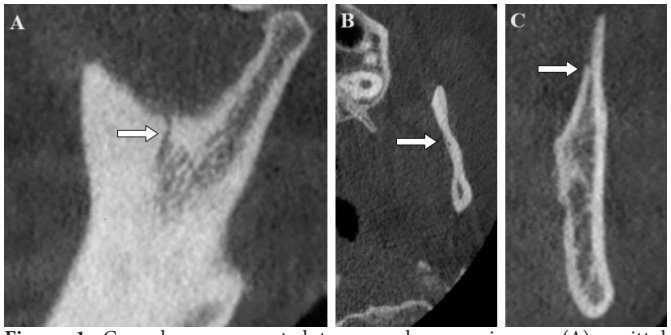

Figure 1. Cone beam computed tomography scan images (A) sagittal section image of sigmoid canal (B) horizontal section image of sigmoid canal (C) coronal section image of sigmoid canal

MRI evaluation: Imaging parameters included a field of view of 200*230, a matrix of 256*256, and slices with a thickness of 3 mm, using a 3.0 Tesla MRI device (Magnetom Skyra; Siemens Medical Solutions, Erlangen, Germany). The images consisted of T1-weighted images (666/11 TR/TE) obtained in closed and open mouth positions. MRI, an image with well defined borders was observed, consistent with the hypointense vascular structure extending downwards from the sigmoid notch (Figure 2).

Figure 2. Magnetic resonance scan images of sigmoid canal in sagittal section

DISCUSSION

While some anatomical variations are known, new variations are continually being added to the literature as medical imaging techniques advance.[11] With evolving medical imaging techniques, even the slightest changes in observed structures can be detected. When two-dimensional medical imaging techniques are insufficient, three-dimensional imaging methods are employed.[12] CBCT provides advantages in imaging hard tissue variations due to its ease of use, sectional examination capability, short scanning time, and relatively low radiation dose compared to computed tomography (CT).[12-14] MRI is a popular imaging modality for observing soft tissue due to its non-ionizing radiation, ability to provide sectional images, tissue type differentiation, and absence of known biological damage.[15]

Slight variations from typical anatomical descriptions can be observed in all structures of the body. However, the presence of these differences does not necessarily imply a pathological condition within that structure.[11] Nevertheless, some anatomical variations containing neurosensory bundles may not only lead to anesthesia failure or difficulties in bleeding control due to containing vascular bundles but also facilitate tumor spread.[16] The ease of tumor spread due to certain intraosseous anatomical variations is assumed to be related to these variations being directly associated with cancellous bone.[17] Some other variations also exist in the ramus region of the mandible. For instance, Vascular structures passing through some anatomical variations can cause various complications. For example, in the case report of Naitoh et al.,[18] a total of 4 bone canals, 3 of which were temporal crest canals, were observed in the imaging of 3 patients. It was mentioned that these bone canals may cause complications in surgical procedures. Similar to Naitoh et al,[18] in two studies

on the mandibular ramus, anatomical variations in this region were analysed and it was stated that these variations may cause complications in surgical procedures.[19,20] Ossenberg[21] published the first case report on the temporal crestal canal, stating that the buccal nerve could pass through this canal and that damage to this structure could lead to various complications. Although the studies have examined the anatomical variations on the ramus, the canal on the sigmoid notch has not been examined.[18-21] It is not possible to observed the content of this canal with CBCT. Therefore, detecting the canal content with MRI is important. MRI examination revealed that the maxillary artery had a branch starting from the sigmoid notch and extending to the ramus. It is possible that unwanted bleeding may occur in this area during surgical interventions on the ramus. It is possible that this branch of the maxillary artery also contains a nerve bundle. It is recommended to conduct further evaluation with CT angiography and histological studies for more detailed examination in future studies.

CONCLUSION

The sigmoid canal is likely to be confused with the fracture line. Therefore, it is important to know the sigmoid canal in order to prevent possible complications, to make the correct clinical diagnosis and to plan the surgical intervention. In addition, there are no research articles in the literature on this variant canal. It would be beneficial to determine the frequency of this canal in different populations.

ETHICAL DECLARATIONS

Informed Consent

The patient signed and free and informed consent form.

Referee Evaluation Process

Externally peer-reviewed.

Conflict of Interest Statement

The authors have no conflicts of interest to declare.

Financial Disclosure

The authors declared that this study has received no financial support.

Author Contributions

All of the authors declare that they have all participated in the design, execution, and analysis of the paper, and that they have approved the final version.

REFERENCES

1. Krasny A, Krasny N, Prescher A. Anatomic variations of neural canal structures of the mandible observed by 3-tesla magnetic resonance imaging. *J Comput Assist Tomogr.* 2012;36(1):150-153.
2. Raikos A, Smith JD. Anatomical variations: How do surgical and radiology training programs teach and assess them in their training curricula? *Clin Anat.* 2015;28(6):717-724.
3. Haas LF, Dutra K, Porporatti AL, et al. Anatomical variations of mandibular canal detected by panoramic radiography and CT: a systematic review and meta-analysis. *Dentomaxillofac Radiol.* 2016; 45(2):20150310.
4. Mclachlan JC, Patten D. Anatomy teaching: ghosts of the past, present and future. *Med Educ.* 2006;40(3):243-253.
5. Hatcher DC. Progressive condylar resorption: pathologic processes and imaging considerations. *Seminars Orthodont.* 2013;19:97-105.
6. Honey OB, Scarfe WC, Hilgers MJ, et al. Accuracy of cone-beam computed tomography imaging of the temporomandibular joint: comparisons with panoramic radiology and linear tomography. *Am J Orthod Dentofacial Orthop.* 2007;132(4):429-438.
7. Standring S. Gray's anatomy e-book: the anatomical basis of clinical practice. Elsevier Health Sciences(2021)
8. Firdoose CSN. Bilateral 'coronoid foramina'with accessory foramina on the 'lateral aspect of ramus' of mandible: an unseen variance discovery in humans. *Surg Radiol Anat.* 2018;40(6):641-646.
9. Kawai T, Asaumi R, Kumazawa Y, et al. Observation of the temporal crest canal in the mandibular ramus by cone beam computed tomography and macroscopic study. *Int J CARS.* 2014;9:295-299.
10. Wang YM, Ju YR, Pan WL, et al. Evaluation of location and dimensions of mandibular lingual canals: a cone beam computed tomography study. *Int J Oral Maxillofac Surg.* 2015;44(9):1197-1203.
11. Georgiev G. Significance of anatomical variations for clinical practice. *Int J Anat Var.* 2017;10(3):43-44.
12. Beck F, Austermann S, Bertl K, et al. Is MRI a viable alternative to CT/CBCT to identify the course of the inferior alveolar nerve in relation to the roots of the third molars? *Clin Oral Investig.* 2021;25:3861-3871.
13. Kaasalainen T, Ekholm M, Siiskonen T, Kortesniemi M. Dental cone beam CT: an updated review. *Phys Med.* 2021;88:193-217.
14. Khalifa HM, Felemban OM. Nature and clinical significance of incidental findings in maxillofacial cone-beam computed tomography: a systematic review. *Oral Radiol.* 2021;37:547-559.
15. Topsakal KG, Korkmaz YN. 3-Dimensional imaging systems in orthodontics: Review of literature. *Selcuk Dent J. 2018;*5(2):186-193.
16. Mistry PN, Rajguru J, Dave MR. Study of the accessory mandibular foramina in dry adult human mandibles and their clinical and surgical implications. *Int J Anatomy, Radiology and Surgery.* 2021;10:16-19.
17. Nayak G, Sahoo N, Panda S. Accessory mandibular foramina and bifid mandibular canals-an anatomical study. *Eur J Anat.* 2019;23(4):261-266.
18. Naitoh M, Nakahara K, Suenaga Y, et al. Variations of the bony canal in the mandibular ramus using cone-beam computed tomography. *Oral Radiol.* 2010;26:36-40.
19. Gunduz K, Serindere G, Avsever H, et al. A detailed CBCT study of 'coronoid foramina'and accessory foramina of the mandible: a unique anatomic variation. *Acta Clin Croat.* 2019;58(4):693-700.
20. Dogan ME, Kaya MS. Examination of coronoid foramen and coronoid canal with CBCT. *Heliyon.* 2024;10(12):E33098.
21. Ossenberg N. Temporal crest canal: case report and statistics on a rare mandibular variant. *Oral Surg Oral Med Oral Pathol.* 1986;62(1):10-12.